2007 RESEARCH PROBLEM STATEMENT

Problem Title: Development of a Decision Support Tool for Assessing Vulnerabiltiy of Transportation Networks **No.:** 07.06-04

Submitted By: Anthony Chen **Email:** achen@cc.usu.edu

Project Champion: Kris Peterson

(UDOT or FHWA employee who needs this research done, will help the Research Division lead this project, and will spearhead the implementation of the results. If the project gets prioritized at the UTRAC conference, a Champion Commitment Form will be required before funding.)

1. Briefly describe the problem to be addressed.

Transportation networks are an indispensable component of everyday life in modern society. Disruption to the networks can make peoples' daily lives extremely difficult as well as seriously cripple economic productivity. This research will develop a decision support tool for assessing vulnerability of transportation networks, identifying the most vulnerable links (chokepoints), and devising remedial strategies to protect the transportation network. The State legislature has provided significant funds to address congestion/choke points. A methodology needs to be developed to determine the most critical choke points that must be addressed.

2. Strategic Goal: ☐ Preservation ☒ Operation ☒ Capacity ☐ Safety (check all that apply)

3A. List the research objective(s) to be accomplished:

1. Development of a decision support tool (software and methodology) for assessing transportation network vulnerability.
2. Analysis of the vulnerability of Utah strategic highway network to determine the most critical chokepoints.

3B. List the major tasks to accomplish the research objective(s): **Estimated person-hours:**

1. Develop vulnerability metrics to quantitatively assess the vulnerability of transportation networks
2. Identify the critical links (chokepoints) of a transportation network using the vulnerability metrics
3. Develop a decision support tool with geographical information systems (GIS) features for transportation network vulnerability analysis
4. Collect relevant data to build the strategic highway system in the State of Utah as a case study
5. Conduct a case study to evaluate the proposed decision support tool
6. Document findings and prepare final report

4. Estimate the cost of this research study including implementation effort (use person-hours from No. 3B): $120,000 ($60,000/yr for 2 years)

5. Indicate type of research and/or development project this is

Large: ☒ Research Project ☐ Development Project
Small: ☐ Research Evaluation ☐ Experimental Feature ☐ New Product Evaluation ☐ Tech Transfer Initiative
☐ Other: _____

(A small project is usually less than $20,000 and shorter than 6 months)

6. Outline the proposed schedule (when do you need this done, and how will we get there):

Conduct a literature review on transportation network vulnerability (July to Sept., 2007)
Develop vulnerability metrics for transportation network vulnerability analysis (Sept. to Dec., 2007)
Collect data and build the Utah strategic highway network (Jan. to March., 2008)
Develop ways to identify the set of critical links (chokepoints) in a network (April to June., 2008)
Develop a decision support tool for transportation vulnerability analysis (July to Dec., 2008)
Conduct a case study to evaluate the vulnerability of Utah strategic highway network (Jan. to April, 2009)
Document findings and prepare final report (May to June, 2009)

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7. What type of entity is best suited to perform this project (University, Consultant, UDOT Staff, Other Agency, Other)?
University

8A. What deliverables would you like to receive at the end of this project? (e.g. useable technical product, design method, technique, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tool, etc.)

1. A decision support tool for assessing transportation network vulnerability (software)
2. Vulnerable links (chokepoints) in the Utah strategic highway network (report)

8B. Describe how this project will be implemented at UDOT.
Once the decision support tool is developed, UDOT can use it as a "what-if" analysis to evaluate different potential disaster (both natural and man-made) scenarios. The results of the scenario analysis can be used to develop strategies to protect the transportation network.

8C. Describe how UDOT will benefit from the implementation of this project, and who the beneficiaries will be.
Results of the proposed research will contribute to better understanding of transportation network vulnerability and allow for better planning, design, and management of transportation systems. We believe these results, particularly the case study using the Utah strategic highway network, will benefit local cities and counties in Utah and UDOT, as these government officials begin to look for ways to deal with a variety of potentially catastrophic natural, technological, and man-made threats in the wake of recent disasters.

9. Describe the expected risks and obstacles as well as the strategies to overcome them.
In order to have accurate and reliable results, reliable input data are crucial. UDOT needs to collect relevant data to build the Utah strategic highway network.

10A. List other people (UDOT and non-UDOT) who are willing to participate in the Technical Advisory Committee (TAC) for this study:

Name	Organization / Division / Region	Phone	Email
Darin Duersch	UDOT/Reg. 1	801 620-1607	DDUERSCH@utah.gov
Dave Kinnecom	UDOT/ TOC	801 887-3707	DKINNECOM@utah.gov

10B. Identify other Utah, regional, or national agencies and other groups that may have an interest in supporting this study:
The focus on congestion remediation and chokepoints coincides with one of FHWA's key research areas: the reduction of congestion. Due to this fact the Utah Transportation Center, a Federally funded Tier II Transportation Center at Utah State University, would be willing to commit funding to assist in the conduct and completion of this research project.